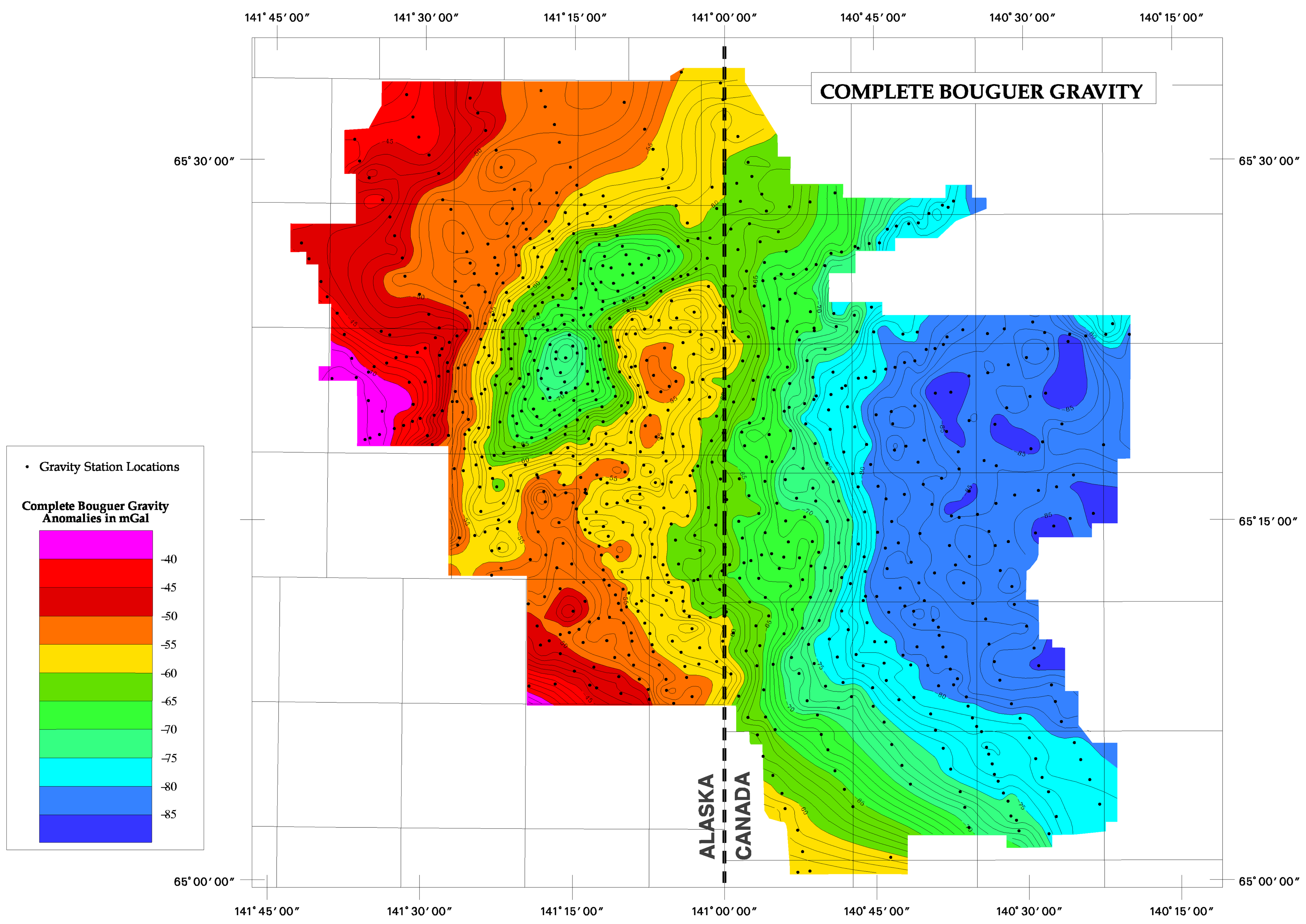
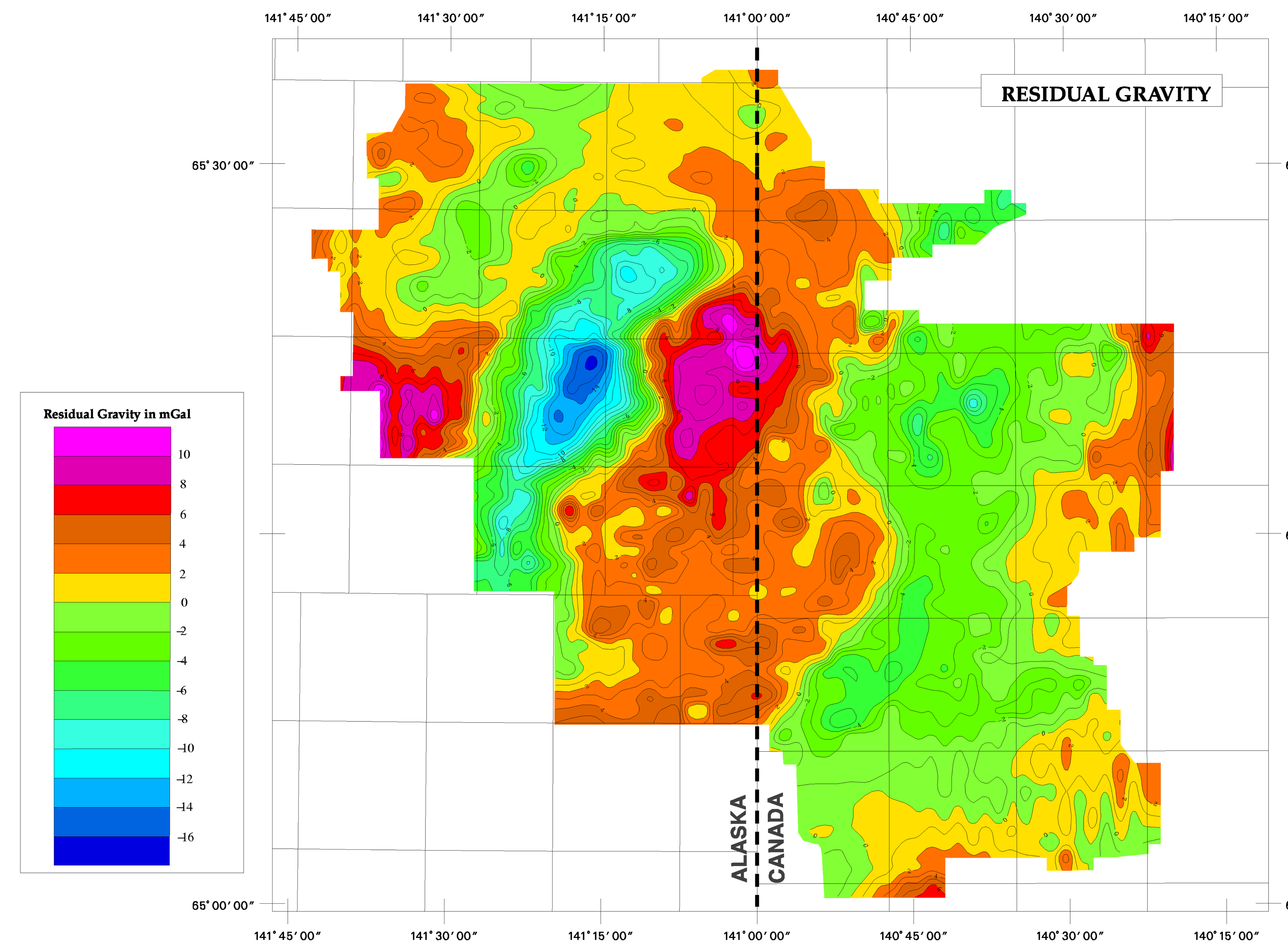
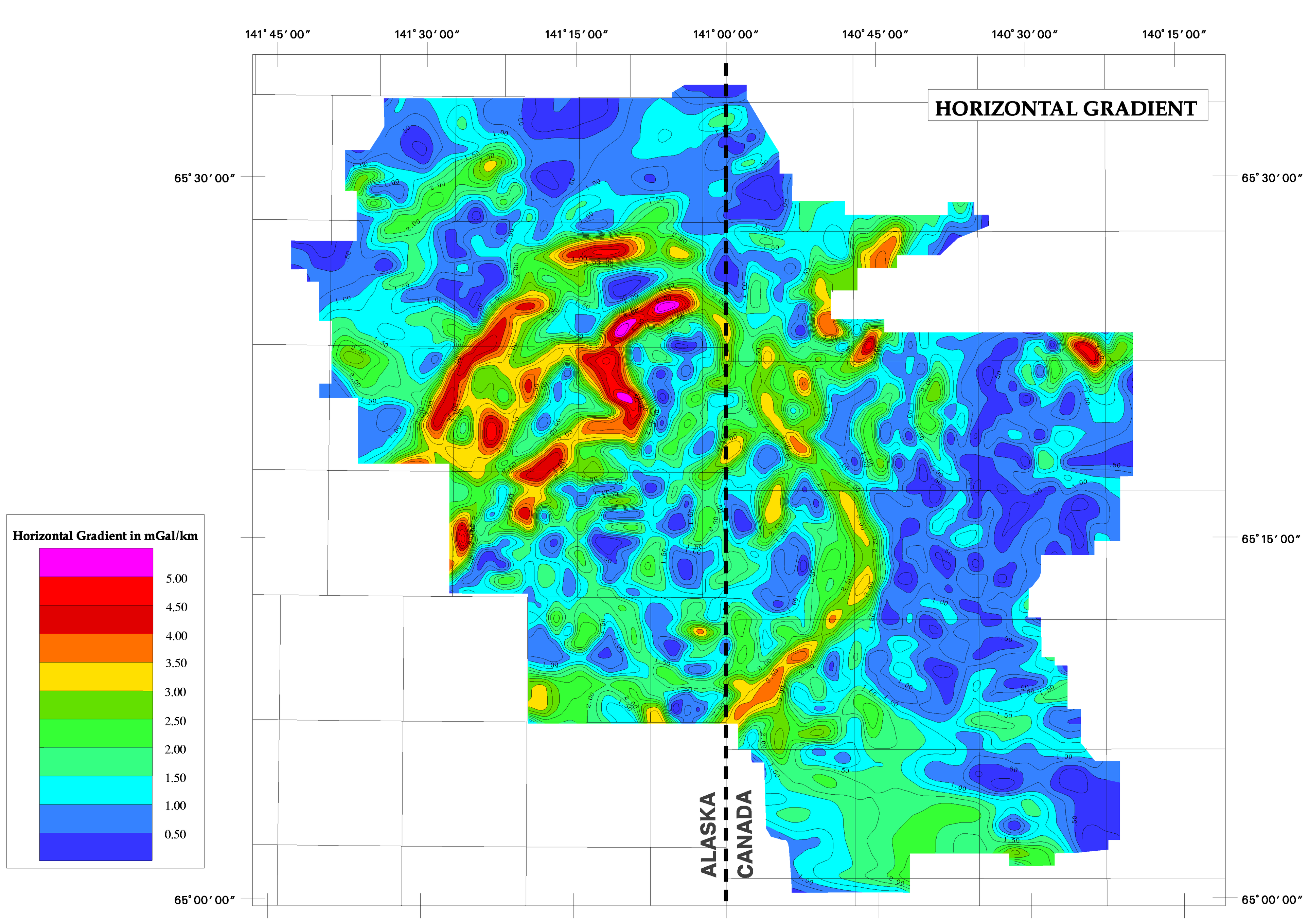
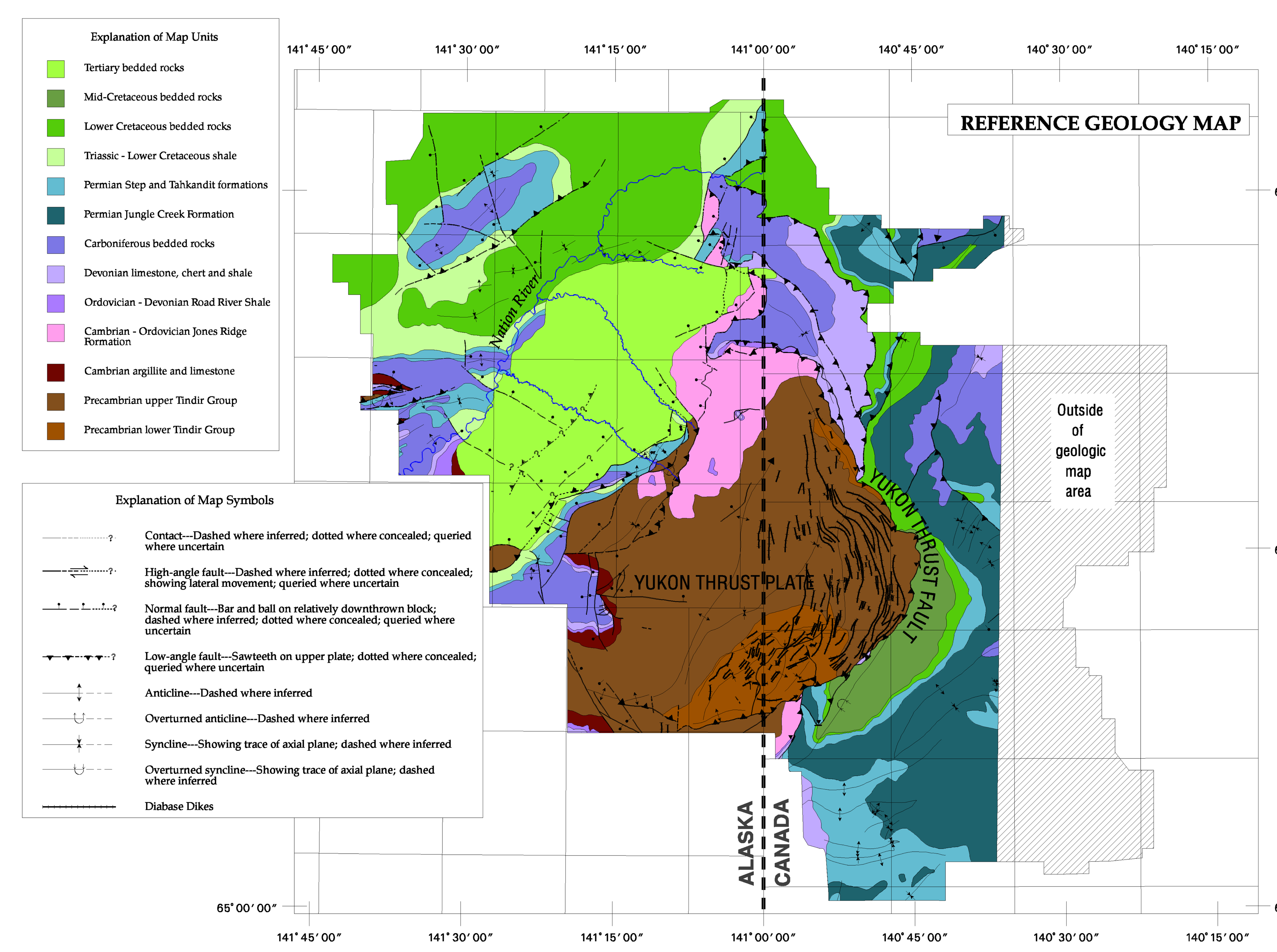






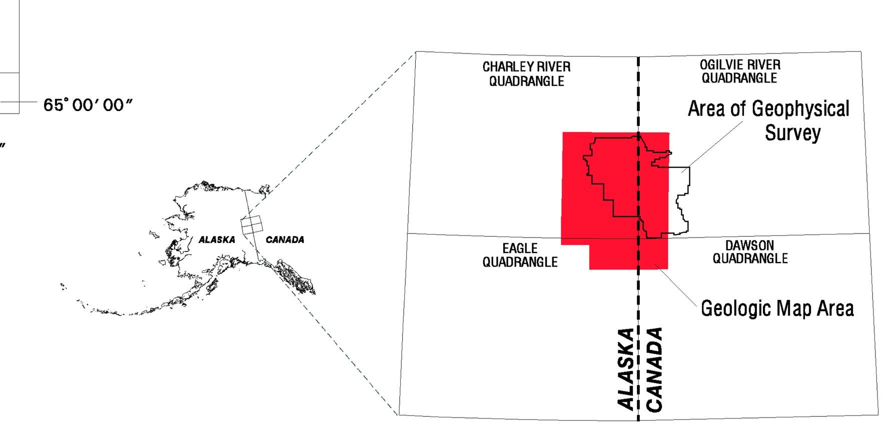


Cartography by DeAnne S. Pinney and L. Katherine Queen

SCALE 1:250,000

5 0 5 10 15 20 MILES

5 0 5 10 15 20 25 30 KILOMETERS



GRAVITY DATA INTERPRETATION
by Paul H. Daggett

About 1,000 gravity stations were acquired in the Kandik-Nation River basin area in 1989 and 1990 by ARCO Alaska, Inc. Stations west of longitude 141°W were collected along profiles spaced about 1 mile apart (1.6 km) with a 0.5 mile (0.8 km) spacing between stations. The stations east of 141°W were collected along profiles 1.5 to 2 miles (2.4-3.2 km) apart with a 1 mile (1.6 km) spacing between stations. The gravity data were acquired during helicopter-supported surveys. Station position and elevation were determined by using an inertial navigation system aboard the helicopter. The elevation error for all stations was less than 1 foot (0.3 m) and the accuracy of the gravity data is about 0.15 mGal.

After making corrections for gravimeter drift, station elevation, and latitude, the simple Bouguer gravity anomaly values were terrain-corrected out to Hammer Zone M (a radius of 13.6 miles) using available 1:63,360- and 1:100,000-scale topographic maps. The complete Bouguer gravity anomaly values were then machine-gridded at a 1-km grid interval and contoured at a 1-mGal contour interval. Residual gravity and horizontal gradient maps were generated from the complete Bouguer gravity anomaly grid to aid the geological interpretation of the gravity data.

The residual gravity grid was calculated by using the method of LaFehr and MacQueen (1990). This method removes the high-frequency components induced into the regional by measurements made on an irregular surface. First, the complete Bouguer gravity anomaly grid was upward-continued to a datum elevation of 5,000 ft (1,524 m). Next, a regional gravity field was calculated by fitting a third-order polynomial surface to the upward-continued complete Bouguer gravity anomaly grid. The regional gravity grid was then downward-continued to the observation surface and subtracted from the complete Bouguer gravity anomaly grid. The residual gravity map was machine-contoured from the resulting residual gravity grid and contoured at a 1-mGal contour interval.

The horizontal gravity gradient grid was calculated from the complete Bouguer gravity anomaly grid by using the method of Cordell (1979). The horizontal gradient is useful as an edge indicator. For planar contacts between rocks of differing densities, the maxima of the horizontal gradient are located down-dip of the uppermost corner of the contacts. The separation distance between the location of the gradient maximum and the edge of the contact is a function of the dip angle of the contact and the depth to the top of the contact (Grauch and Cordell, 1987). When density contacts are dipping at an angle of greater than 45°, the gradient maxima will occur over the contact. As the dip angle decreases, the gradient maxima will move down-dip from the contact.

DISCUSSION

Density measurements were made on about 1,100 outcrop samples from the Kandik-Nation River area to aid the gravity interpretation. The dominant feature on the complete Bouguer gravity anomaly and residual gravity anomaly maps is the transition between the high-density Precambrian rocks of the upper plate of the Yukon Thrust Fault and the lower density Cretaceous rocks of the lower plate. Along the Yukon Thrust Fault to the north, there are well-defined gravity anomalies associated with the imbricate thrust faults that splay off of the main thrust. Within the Yukon Thrust Plate, residual positive gravity anomalies occur over surface anticlines and residual gravity lows occur over surface synclines.

As discussed above, the horizontal gradient map is an edge indicator. The gradient maxima associated with the Yukon Thrust Fault are about 1 mile (1.6 km) down-dip (west) of the surface trace of the fault. The large offset distance between the surface trace of the fault and the gradient maxima suggests the dip of the fault plane is less than 20°. However, to the north, the offset distance is smaller along the imbricate faults than along the main fault. Therefore, the dip angle of the imbricate fault planes is greater (>45°) than the dip of the main thrust fault plane. The horizontal gradient maxima on the Yukon Thrust Sheet parallel but are coincident with structural fold axes. These observations are consistent with the surface geologic mapping in the area (Van Kooten and others, 1996).

ACKNOWLEDGMENTS

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GRAVITY MAPS OF THE KANDIK AREA, ALASKA, AND ADJACENT YUKON TERRITORY, CANADA

by

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